

REMARKS

Claims 1-20 are pending in this application. Claims 1 and 11 are independent claims. Claims 11-16 were previously withdrawn from consideration. Claim 1 has been amended to recite in step (c) preferred aspects of the present invention of “distilling stream 2 at a bottom temperature of 40 to 180°C and a pressure of 10 mbar to 500 mbar to obtain a stream 4 as the top product”. Support can be found at page 21, lines 16-18 of the specification. Claim 1 has also been amended to clarify that the stream 7 is recycled to the isomerization stage. This is supported at page 2., lines 34 and 35 of the specification. In view of the amendments to claim 1, claims 17, 18 and 20 have been amended by deleting language that would be inconsistent or redundant with claim 1 as amended. The amendments to the claims do not introduce any new matter.

Claims 1-10 and 17-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,356,748 to Drinkard et al. (hereinafter also referred to as “Drinkard”) in view of U.S. Patent No. 6,242,633 to Fischer et al.¹ (hereinafter also referred to as “Fischer”) and International Publication No. WO 02/26698² to Jungkamp et al. (hereinafter also referred to as “Jungkamp”). The cited references do not render obvious the present invention.

The present invention describes a process for preparing 3-pentenitrile by isomerizing streams comprising 2-methyl-3-butenitrile. An important aspect of the invention is the removal of (Z)-2-methyl-2- butenenitrile.

The problem addressed by the invention was that of providing a process for preparing 3-pentenitrile by isomerizing 2-methyl-3-butenitrile, which fulfills the following requirements:

- 1) simple removal and recycling of the isomerization catalyst;
- 2) removal of (Z)-2-methyl-2-butenitrile from 2-methyl-3-butenitrile;
- 3) recycling of the 2- methyl-3-butenitrile depleted of (Z)-2-methyl-2-butenitrile;
- 4) technically simple and economically practical process which can be incorporated into an overall process for preparing adiponitrile.

¹ Fisher et al. is owned by BASF AG and names an inventor in common to the present application.

² WO 02/26698 is also owned by BASF AG and also names co-inventors common to the present application.

The problem is solved by the measures recited in the present claims.

The present invention is patentably distinct from the cited art since, among other things, component step (1c) of claim 1, the distillative removal of the 2-methyl-2-butenenitriles (2M2BN) from 2-methyl-3-butenenitrile (2M3BN), is not suggested by the cited art. The reaction effluent from the isomerization of 2-methyl-3-butene (2M3BN) comprises, as secondary components, (E)- and (Z)-2-methyl-2-butenenitrile (2M2BN). Both compounds differ from 2M3BN by the position of the double bond. They have to be removed since they would otherwise accumulate in the process.



The removal of (Z)-2M2BN is particularly difficult. Unless removed, this isomer would automatically get into the isomerization stage together with 2M3BN and accumulate. As a result of the accumulation of these secondary components, expensive reaction volume would be lost. The boiling point of (Z)-2M2BN differs only slightly from the boiling point of 2M3BN.

Examples in the specification demonstrate unexpected results achievable by the present invention. Along these lines, the claimed process provides low losses of 2-methyl-3-butenenitrile during distillative separation of (Z) 2-methyl-2-butenenitrile (cf. example 1-4 of the present specification). This is surprising since the boiling points of both compounds differ only slightly from each other.

US-A-3,865,865 (cited in the present application) discloses that the removal of 2-methyl-2-butenenitrile (2M2BN) by distillation from mixtures of 3-pentenitrile and 2-methyl-3-butenenitrile (2M3BN) presents difficulties (please see column 1, lines 26 to 29).

It would be possible to obtain pure 2M3BN from the mixtures mentioned, by distillation, which can be recycled into the isomerization stage. However, high losses of 2-methyl-3-butenenitrile would be expected, since large amounts of 2M3BN would also be lost in the mixture

with the 2M2BN discharged. This would significantly reduce the commercial, economic and practical viability of such a process.

Moreover, the process described in US-A-3,865,865 points away from the distillative removal of (Z)2M2BN: the reaction mixture from the isomerization is instead reacted with aqueous alkali metal sulfite/alkali metal bisulfite solutions to give adducts which can be extracted from the reaction mixture with water. This process is very costly and inconvenient since it constitutes a new additional process step.

As appreciated by the examiner, Drinkard et al. fail to disclose the crucial distillation steps **(c)** and **(d)** pointed out above. By contrast to the present invention, Drinkard et al. relate to the isomerization of 2-methyl-3-butenenitrile with a Ni [P (OC₂H₅)₃]₄ catalyst, so as to yield a liquid product stream which is then vacuum-distilled. The distillate includes 2-methyl-3-butene nitrile, 3-pentenitrile, 2-methyl-2-butenenitrile and 4-pentenitrile. The bottom stream composition is not further described, but one would expect it to contain the catalytic system and possible solvents.

As mentioned above, the subject matter of present claim 1 clearly differs from Drinkard et al., i.e., by the above-recited distillation steps **(c)** and **(d)**. This presently claimed combination of features is neither known nor can be directly derived from Drinkard et al., either alone or in combination with Fischer et al. and Jungkamp et al. In particular, the Office has not shown that there would be an apparent reason to modify Drinkard et al. with Fischer et al. and Jungkamp et al.³ Fischer et al. do not overcome the above deficiencies of Drinkard et al. with respect to rendering unpatentable the present invention. Fischer et al. fail to suggest the crucial distillation steps (c) and (d) or the recited recycling according to the present invention. Fischer et al. were relied upon for a disclosure of nickel isomerization catalysts.

WO 02/26698 to Jungkamp et al. does not overcome the above deficiencies of Drinkard et al. with respect to rendering unpatentable the present invention. WO 02/26698 fails to even remotely suggest the isomer mixture treated according to the present invention or the improved

³ In fact, the conclusion in the International Preliminary Report on Patentability (copy attached) was that the claims were novel, inventive and had industrial utility.

results obtainable by the present invention. Furthermore, selection of the pressures employed for distillation steps (b), (c) and (d) along with the particular mixtures subjected to the distillations is not suggested by Jungkamp et al.

The removal of (E)-2M2BN from (E)-2M2BN/2M3BN mixtures by distillation is described in WO 02/26698 Table 1, comparative example 3, but only at standard pressure. The inventive improvement is achieved after addition of water (Example 3) by azeotropic distillation. The removal of (Z)-2M2BN is not described.

It has been found in accordance with the invention that surprisingly, (Z)-2-methyl-2-butenitrile can be enriched greatly in the course of distillation under reduced pressure (e.g. Example 1, page 76 lines 3 to 4, top pressure 250 mbar, top temperature 80°C and bottom temperature 100°C) as a top product of column K5 (stream 4). The top product consists of 41% (Z)-2M2BN and of 50% 2M3BN (Table 1). Stream 100(%)

Table 1

Examples (Fig. No.)	Column No.	Stream 4, Composition		Stream 4	Stream 5	Stream 4 [100%]
	Stream No.	[%]		[kg/h]	[kg/h]	Stream 4+ 5
		2M3BN	(Z)-2M2BN			
1 (Fig. 3)	Top product of column K5, stream	50	41	0.8	39	2

In the gaseous side draw of column K5, a stream 5 is surprisingly obtained, which contains almost only 3-pentenitrile and 2-methyl-3-butenitrile and can be recycled into column K3. (Z)-2M2BN is greatly depleted in this stream.

It was also unforeseeable that the discharged stream 4, based on stream 4, stream 5, makes up only 2% (Table 1). This also means that only a small amount of 2-methyl-3-butenitrile is lost in the discharge.

Moreover, the relative antiquity of Drinkard et al. is further indicia of the non-obviousness of the present invention. Along these lines, please see *In re Adams* 148 USPQ 743 (CCPA, 1966) and *In re Lechen*, 125 USPQ 396 (CCPA, 1960).

In conjunction with interpreting 35 U.S.C. §103 under *Graham V. John Deere*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) and *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), the initial burden is on the Patent Office to provide some apparent reason or suggestion of the desirability of doing what the inventor did, i.e. the Patent Office must establish a *prima facie* case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention, or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Moreover, MPEP, § 706.02(j), states that "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Also, please see *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985).

In addition, the prior art reference (or references, when combined) must teach or suggest all of the claim limitations.

The mere fact that cited art may be modified in the manner suggested in the Office Action does not make this modification obvious, unless the cited art suggests the desirability of the modification or impliedly suggests the claimed invention, or the Examiner has presented a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. No such suggestion appears in the cited art in this matter nor has a convincing line of reasoning been presented in this case. The Examiner's attention is kindly directed to *KSR Int'l Co. v. Teleflex, Inc.*, *supra*; *In re Dembiczak et al.*, 50 USPQ2d.1614 (Fed. Cir. 1999), *In re Gordon*, 221 USPQ 1125 (Fed. Cir. 1984), *In re Laskowski*, 10 USPQ2d, 1397 (Fed. Cir. 1989) and *In re Fritch*, 23, USPQ2d. 1780 (Fed. Cir. 1992).

Furthermore, the cited art lacks the necessary direction or incentive to those of ordinary skill in the art to render a rejection under 35 USC 103 sustainable. The cited art fails to provide the degree of predictability of success of achieving the properties attained by the present invention needed to have a rejection under 35 U.S.C. 103 sustained. See *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), *Diversitech Corp. v. Century Steps, Inc.*, 7 USPQ2d 1315 (Fed. Cir. 1988), *In re Mercier*, 187 USPQ 774 (CCPA 1975) and *In re Naylor*, 152 USPQ 106 (CCPA 1966). In particular, the claimed process provides low losses of 2-methyl-3 butenenitrile during distillative separation of (Z) 2-methyl-2- butenenitrile (cf. example 1-4 of the present specification). This is quite surprising since the boiling points of both compounds are only slightly different.

Moreover, the properties of the subject matter and improvements which are inherent in the claimed subject matter and disclosed in the specification are to be considered when evaluating the question of obviousness under 35 USC 103. See *KSR Int'l Co. v. Teleflex, supra*, *Gillette Co. v. S.C. Johnson & Son, Inc.*, 16 USPQ2d 1923 (Fed. Cir. 1990), *In re Antonie*, 195 USPQ 6 (CCPA 1977), *In re Estes*, 164 USPQ 519 (CCPA 1970), and *In re Papesch*, 137 USPQ 43 (CCPA 1963).

No property can be ignored in determining patentability and comparing the claimed invention to the prior art. Along these lines, see *In re Papesch, supra*, *In re Burt et al*, 148 USPQ 548 (CCPA 1966), *In re Ward*, 141 USPQ 227 (CCPA 1964), and *In re Cescon*, 177 USPQ 264 (CCPA 1973).

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees to Deposit Account No. 03-2775, under Order No. 12810-00322-US1 from which the undersigned is authorized to draw.

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Respectfully submitted,

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